YIELD OF BEANS IN RESPONSE TO CHEMICAL FOLIAR APPLICATIONS AT FLOWERING STAGE

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Introduction

Abortion of up to 85% of developing flower buds is a major contributor to low productivity in common bean. Since fertilization of flowers occurs within a few hours of pollination, even short-term environmental stresses at this critical time could cause reduced flower set and pod retention. Minerals, vitamins, and other nutritional constituents, which in vitro improved pollen germination and pollen tube growth, have not been investigated extensively under field environments (Weaver et al., 1985). These authors verified that sprays of calcium nitrate, boric acid, different sugars and other products at first flower opening stage altered pod retention and seed yield, but response varied with beans source. In Brazil, some farmers of sprinkler irrigated areas of beans cultivated during fall-winter are applying solutions of sugar or calcium, of different concentrations, during the flowering of beans. Increase in bean yields have been reported by some farmers. This study was undertaken to determine if foliar-applied chemicals could increase seed yield of beans, mainly under irrigated conditions.

Material and Methods

Three trials were installed in Coimbra, Minas Gerais State, Brazil, on 17 July 2000 (trial 1), 7 March 2001 (trial 2), and 24 July 2001 (trial 3). These trials were sprinkler irrigated. Another trial was installed in Viçosa, Minas Gerais, on 20 October 2001 (trial 4). This trial was carried out during the rainy season when temperatures are higher. The cultivar Pérola (carioca class) was used in Coimbra and the cultivar Ouro Negro (black), in Viçosa. Both cultivars are type III and were sown in rows 0.5 m apart with approximately 15 seeds per meter. Plants were sprayed (450 liters/ha) when 20% to 100% of plants had at least one open flower with the following chemicals: 1) control (tapwater); 2) calcium nitrate (300 mg/liter); 3) boric acid (100 mg/liter); 4) sucrose 1.0% (w/v); 5) combination of 2 and 3; 6) combination of 2 and 4; 7) combination of 3 and 4; and 8) combination of 2, 3 and 4. Each plot contained four rows 5 m long. A randomized complete-block design with seven replications was used. Fertilizer (8-28-16), at a rate of 350 kg/ha, was banded 4-5 cm deep at planting. Between twenty and twenty-eight days after emergence 100 kg/ha of urea were distributed along the bean lines. Weeds were controlled with hoe and with the postemergence herbicides fomesafen + fluazifop. A broad-spectrum fungicide was applied, preventively, three times. Insects were controlled when necessary.

Results and Discussion

Only in trial 1 there was significant difference among treatments (Table 1). Yield of treatment with spray of boric acid + sucrose (2,546 kg/ha) was superior to yield of treatments 1 (2,197 kg/ha), 2 (2,258 kg/ha), and 8 (2,257 kg/ha). Treatments 5, 6, and 7 also differ significantly from control. In this trial, there was a problem with the irrigation pump during parts of stages R6 (flowering) and R7 (pod development) of beans. Consequently, those plants suffered a period of water stress, which did not happened in trials 2 and 3. During trial 4, rains were more constant and intense than normal and temperatures lower than normal. This situation

meant no significant stress for beans in trial 4. These results show that chemical foliar applications at flowering are not efficient when beans do not suffer stress.

Table 1. Mean seed yields of dry beans in four trials, Minas Gerais State, Brazil.

Foliar treatments[1]	Seed yield (kg/ha)			
	Trial 1	Trial 2	Trial 3	Trial 4
1. Control	2,197 c[2]	3,365	2,728	2,278
2. Calcium nitrate (300 mg/l)	2,307 abc	3,314	2,385	2,142
3. Boric acid (100 mg/l)	2,258 bc	3,553	2,622	2,313
4. Sucrose (1%)	2,437 abc	3,276	2,750	2,310
5. Calcium nitrate (300 mg/l) + Boric acid (100 mg/l)	2,481 ab	3,370	2,782	2,342
6. Calcium nitrate (300 mg/l) + Sucrose (1%)	2,481 ab	3,196	2,691	2,236
7. Boric acid (100 mg/l) + Sucrose (1%)	2,546 a	3,314	2,907	2,209
8. Calcium nitrate (300 mg/l) + Boric acid (100 mg/l) + Sucrose (1%)	2,257 bc	3,390	2,923	2,404

[1] All treatments included 0.05% Tween 20 surfactant.
[2] Means separation within columns by Duncan's multiple range test, 5% level.

Reference

Weaver, M.L., Timm, H., Ng, H., Burke, D.W., Silbernagel, M.J., Foster, K. 1985. Pod retention and seed yield of beans in response to chemical foliar applications. Hort. Sci. 20:429-31.